

CLAIMS

1. A method of activating the function of a protein that is inactive due to a disordered higher order structure, comprising

bringing the protein into a state that can express a function inherent to the protein, by bringing the protein into contact with zeolite beta.

2. The method according to claim 1, wherein the protein is brought into contact with the zeolite beta in the presence of a protein denaturant, a surfactant, and/or a refolding buffer.

3. The method according to claim 1, wherein the protein that is inactive due to a disordered higher order structure is a protein that is produced by an Escherichia coli expression system.

4. The method according to claim 1, wherein the protein that is inactive due to a disordered higher order structure is a protein that is deactivated due to its thermal history.

5. The method according to claim 1, wherein the protein is adsorbed to the zeolite beta by mixing with a solution that contains the zeolite beta or by introduction onto a column packed with the zeolite beta and is then desorbed from the zeolite beta.

6. A method for reforming the core structure of a protein, comprising

refolding the conformation of a protein that is inactive due to a disordered higher order structure by bringing the protein into contact with zeolite beta.

7. A method for producing an active protein, comprising refolding the conformation of a protein that is inactive due to a disordered higher order structure by bringing the protein into contact with zeolite beta, thereby producing a protein that has a controlled higher order structure and an activated native function inherent to the protein.

8. The method for producing a protein according to claim 7, comprising

refolding the conformation of an inactive protein produced by *Escherichia coli* that incorporates the genetic code responsible for the synthesis of a target protein, by bringing the inactive protein into contact with zeolite beta.

9. A protein refolding kit that is a reagent kit used in a protein function activation (refolding) protocol or step that modulates the higher order structure of a protein that is inactive due to a disordered higher order structure, thereby activating the protein, wherein the protein refolding kit contains a refolding agent comprising zeolite with the BEA structure (zeolite beta) as a constituent.

10. The refolding kit according to claim 9, wherein the kit has protein denaturant, pH regulator, and refolding agent comprising the zeolite beta as basic constituent components

and additionally comprises a combination that contains at least one selection from agents that inhibit the formation of protein S-S bridges, surfactants, and refolding factors.

11. The refolding kit according to claim 9 or 10, wherein the framework structure of the zeolite beta contains silicon, oxygen, and at least one element other than silicon and oxygen.

12. The refolding kit according to any of claims 9 to 11, wherein the framework structure of the zeolite beta comprises only silicon and oxygen or only silicon and aluminum and oxygen.

13. The refolding kit according to any of claims 9 to 12, wherein the zeolite beta contains an ammonium species.

14. The refolding kit according to claim 13, wherein the ammonium species is ammonium ion, an organic amine, and/or an acid amide.

15. The refolding kit according to claim 14, wherein the organic amine is a tetraalkylammonium.

16. The refolding kit according to any of claims 10 to 15, wherein the protein denaturant in the kit is guanidine hydrochloride.

17. The refolding kit according to any of claims 10 to 16, wherein the pH regulator in the kit is trisaminomethane trihydrochloride (TrisHCl) and/or 4-(2-hydroxyethyl)-1-piperazineethanesulfonic acid (HEPES).

18. The refolding kit according to any of claims 10 to 17, wherein the agent in the kit that inhibits the formation of protein S-S bridges is 2-mercaptoethanol, dithiothreitol, cystine, or thiophenol.

19. The refolding kit according to any of claims 10 to 18, wherein the surfactant and refolding factor in the kit are at least one selection from polyethylene glycol, Ficoll170, Ficoll1400, polyphosphoric acid, sodium dodecyl sulfate (SDS), sucrose, glucose, glycerol, inositol, cyclodextrin, amylose, Dextran T-500, Tween 20, Tween 40, Tween 60, NP-40, SB3-14, SB12, CTAB, and Triton X-100.

20. The refolding kit according to any of claims 9 to 15, wherein the kit comprises said refolding agent, guanidine hydrochloride, TrisHCl, 2-mercaptoethanol, and a solution (the refolding buffer) comprising HEPES, alkali halide, 2-mercaptoethanol, refolding factor, and surfactant, or the kit comprises the refolding buffer, the refolding agent, guanidine hydrochloride, TrisHCl, 2-mercapethanol, and alkali halide.

21. A protein refolding agent that has a protein refolding action that modulates the higher order structure of and activates a protein that is inactive due to a disordered higher order structure, the protein refolding agent comprising zeolite with the BEA structure (zeolite beta).

22. The refolding agent according to claim 21, that carries out protein refolding in the presence of a protein denaturant, a surfactant, and/or a refolding buffer.

23. The refolding agent according to claim 21, wherein the protein that is inactive due to a disordered higher order structure is a protein that is produced by an Escherichia coli expression system.

24. The refolding agent according to claim 21, wherein the protein that is inactive due to a disordered higher order structure is a protein that is deactivated due to its thermal history.

25. The refolding agent according to claim 21, wherein the zeolite beta contains ammonium ion, an organic ammonium ion, and/or urea.

26. The refolding agent according to claim 25, wherein the organic ammonium ion is a mono-, di-, tri-, and/or tetraalkylammonium ion (where the alkyl group is methyl, ethyl, propyl, or butyl).

27. The refolding agent according to claim 21, wherein the framework structure of the zeolite beta comprises oxygen and at least one element other than oxygen.

28. The refolding agent according to claim 27, wherein the framework structure of the zeolite beta comprises silicon and oxygen or silicon, aluminum, and oxygen.

29. The refolding agent according to any of claims 21 to 28, that manifests a protein refolding action through contact with a protein dispersed in a solution.

30. The refolding agent according to any of claims 21 to 29, that causes refolding of the protein by a procedure in

which said protein in a solution is adsorbed by mixing with the refolding agent or by introduction onto a column packed with the refolding agent and thereafter is desorbed.

31. A refolding molding comprising a molding that contains zeolite with the BEA structure (known as zeolite beta) that has the capacity, denoted as a refolding activity, to modulate and activate the higher order structure of a protein that is inactive due to a disordered higher order structure.

32. The refolding molding according to claim 31, wherein the molding comprises zeolite beta or zeolite beta and a substrate that supports the zeolite beta.

33. The refolding molding according to claim 31, that manifests a refolding activity upon contact with a protein.

34. The refolding molding according to claim 31, that carries out the refolding of a protein in the presence of a protein denaturant, a surfactant, and/or a refolding buffer.

35. The refolding molding according to claim 31, wherein the protein that is inactive due to a disordered higher order structure is a protein that is produced by an Escherichia coli expression system.

36. The refolding molding according to claim 31, wherein the protein that is inactive due to a disordered higher order structure is a protein deactivated due to its thermal history.

37. The refolding molding according to claim 31, wherein the zeolite beta contains ammonium ion and/or organic ammonium ion.

38. The refolding molding according to claim 37, wherein the organic ammonium is a mono-, di-, tri-, and/or tetraalkylammonium ion (where the alkyl group is methyl, ethyl, propyl, or butyl).

39. The refolding molding according to claim 31, wherein the framework structure of the zeolite beta comprises oxygen and at least one element other than oxygen.

40. The refolding molding according to claim 39, wherein the framework structure of the zeolite beta comprises silicon and oxygen or silicon, aluminum, and oxygen.

41. The refolding molding according to any of claims 31 to 40, that manifests a protein refolding activity through contact with a protein dispersed in a solution.

42. The refolding molding according to any of claims 31 to 41, that has a function that causes refolding of the protein by a procedure in which the protein is adsorbed to the molding by mixing the protein in a solution with the refolding molding or by flowing or dripping the protein in a solution onto the molding and thereafter is desorbed.